2001 LECTURES ON QUANTUM FIELDS AND STRINGS FOR MATHEMATICIANS

BENJAMIN MCKAY

References

- Pierre Deligne, Pavel Etingof, Daniel S. Freed, Lisa C. Jeffrey, David Kazhdan, John W. Morgan, David R. Morrison, and Edward Witten, editors. *Quantum fields and strings: a course for mathematicians. Vol. 1, 2.* American Mathematical Society, Providence, RI, 1999. Material from the Special Year on Quantum Field Theory held at the Institute for Advanced Study, Princeton, NJ, 1996–1997.
- [2] Richard P. Feynman. Selected papers of Richard Feynman, volume 27 of World Scientific series in 20th century physics. World Scientific, Singapore, 2000. Edited with commentary by Laurie M. Brown.
- [3] Daniel S. Freed. Five lectures on supersymmetry. American Mathematical Society, Providence, RI, 1999.
- [4] P. Ginsparg. Applied conformal field theory. In Champs, cordes et phénomènes critiques (Les Houches, 1988), pages 1–168. North-Holland, Amsterdam, 1990. This seems to be the bible for conformal field theory. We need to understand at least some parts of conformal field theory before going too far in string theory.
- [5] Th. Kaluza. On the problem of unity in physics. Sitz. Preuss. Akad. Wiss., K1:966, 1921. Also found in English translation in [7], pp. 53–58. The first article on Kaluza–Klein theories.
- [6] Oskar Klein. Quantentheorie und fünfdimensionale Relativitätstheorie. Zeitschrift für Physik, 37:895, 1926. Also found in English translation in [7], pp. 59–58.

The second article on Kaluza–Klein theories.

- [7] Lochlainn O'Raifeartaigh, editor. The dawning of gauge theory. Princeton University Press, Princeton, NJ, 1997. Edited and with introductory essays by Lochlainn O'Raifeartaigh.
- [8] Michael E. Peskin and Daniel V. Schroeder. An introduction to quantum field theory. Addison-Wesley Publishing Company Advanced Book Program, Reading, MA, 1995. Edited and with a foreword by David Pines.

Date: September 28, 2001.

BENJAMIN MCKAY

Many people say this is the best book from which to learn quantum field theory.

 [9] Joseph Polchinski. Renormalization and effective Lagrangians. Nuclear Physics B, B231:269–295, 1984.

Proves (with rigour of a physicist, of course) via very general arguments the renormalizability of certain quantum field theories.

- [10] Joseph Polchinski. String theory. Vol. I. Cambridge University Press, Cambridge, 1998. An introduction to the bosonic string. Currently the best approach to learning string theory.
- [11] Joseph Polchinski. String theory. Vol. II. Cambridge University Press, Cambridge, 1998. Superstring theory and beyond.
- [12] Julian Schwinger. Quantum electrodynamics. I. A covariant formulation. *Phys-ical Rev.* (2), 74:1439–1461, 1948. Also found in [15], pp. 36–58.
- Julian Schwinger. Quantum electrodynamics. II. Vacuum polarization and selfenergy. *Physical Rev. (2)*, 75:651–679, 1949. Also found in [15], pp. 59–87. This paper was highly recommended by Alvarez in his Park City lectures.
- [14] Julian Schwinger. Quantum electrodynamics. III. The electromagnetic properties of the electron—Radiative corrections to scattering. *Physical Rev. (2)*, 76:790–817, 1949. Also found in [15], pp. 88–115.
- [15] Julian Schwinger. A quantum legacy: seminal papers of Julian Schwinger, volume 26 of World Scientific series in 20th century physics. World Scientific, Singapore, 2000. Edited with commentary by Kimball A. Milton.
- [16] Kenneth G. Wilson. Renormalization group and critical phenomena. I. Phasespace cell analysis of critical behavior. *Physical Review B*, 4(9):3184–3205, November 1971.
- [17] Kenneth G. Wilson. Renormalization group and critical phenomena. I. Renormalization group and the Kadanoff scaling picture. *Physical Review B*, 4(9):3174–3183, November 1971.

The birth of the modern theory of the renormalization group.

- [18] Kenneth G. Wilson. Renormalization group methods. Advances in Math., 16:170–186, 1975.
 A review of the renormalization group as applied to the problem of dilute impurities in ferromagnets.
- [19] Kenneth G. Wilson and J. Kogut. The renormalization group and the ε expansion. *Physics Reports*, 12C(2):77–199, August 1974.

A monograph explaining the renormalization group for people who don't know much physics beyond the expansion of ϕ^4 field theory into Feynman diagrams.

UNIVERSITY OF UTAH, SALT LAKE CITY, UTAH *E-mail address*: mckay@math.utah.edu